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Distribution of *Acipenser sturio* L., 1758 in the Black Sea and its watershed

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ABSTRACT

The Atlantic sturgeon *Acipenser sturio* L., 1758, was always rare in the Black Sea, and the least numerous in comparison with other sturgeons. At the end of the 19th and the first half of the 20th centuries, it occurred along almost the entire Black Sea coast. It has been distributed predominantly in the eastern part of the Black Sea, especially in the region adjacent to Georgia's Inguri and Rioni rivers, with spawning grounds in the latter. It has also been recorded occasionally in the Danube River, where it occurred mostly in its delta. Earlier records even indicate its reproduction in the Danube. Recently its distribution and population density has been dramatically reduced. The distribution of this species is limited only to the eastern part of the Black Sea, and the recent total density of adults is estimated at only several hundred specimens. This situation has placed *A. sturio* on the list of critically endangered fish species. Existing data on its morphology and ecology indicate some differences between the Black Sea stock and populations from the Atlantic Ocean and the Baltic and Mediterranean Seas.

Key words: Atlantic sturgeon, Danube River, Rioni River, Inguri River, ecology, conservation.

RESUMEN

Distribución de* Acipenser sturio *L., 1758 en el mar Negro y su cuenca

El esturión atlántico Acipenser sturio *L., 1758 siempre ha sido raro en el mar Negro, y el menos numeroso en comparación con otros esturiones. A finales del siglo XIX y primera mitad del XX se encontraba a lo largo de toda la costa del mar Negro. Se distribuía predominantemente en la parte oriental del mar Negro, en especial en la región adyacente a los ríos Inguri y Rioni en Georgia, con áreas de freza en este último. También ha sido citado ocasionalmente en el río Danubio, donde ocupaba sobre todo su delta. Las citas más antiguas incluso indican su reproducción en el Danubio. Recientemente su distribución y densidad de población se han visto dramáticamente reducidas. La distribución de esta especie se limita sólo a la parte oriental del mar Negro, y la densidad total reciente de adultos se estima en sólo algunos cientos de individuos. Esta situación ha colocado a* A. sturio *en la lista de especies de peces en peligro crítico. Los datos conocidos sobre su morfología y ecología indican algunas diferencias entre la población del mar Negro y las del océano Atlántico y los mares Báltico y Mediterráneo.*

Palabras clave: *Esturión atlántico, río Danubio, río Rioni, río Inguri, ecología, conservación.*

INTRODUCTION

The Atlantic sturgeon *Acipenser sturio* L., 1758 is the rarest sturgeon species occurring in the Black Sea. Its presence in this region has been recorded quite late (Antipa, 1909), and its relative rarity was the reason why this species was not particularly studied in the countries along the western coast of the Black Sea. Sporadic records on its occurrence and catches are in papers by Antipa (1905, 1909, 1933), Bacalbaşa-Dobrovici *et al.* (1984), Bănărescu (1964), Berg (1948), Borcea (1929, 1933), Drenski (1948), Elanidze (1983), Elanidze *et al.* (1970), Janković (1993, 1994, 1996), Karapetkova and Zhivkov (1995), Kasymov (1972), Kinzelbach (1997), Marinov (1966, 1978), Sal'nikov (1961), Svetovidov (1964), and Vuković and Ivanović (1973). Some of these papers also contain short notes on the biological phenomena of the Black Sea stock, but the most comprehensive information regarding these aspects can be found in Ninua (1976). See Holčík *et al.* (1989) for an extensive summary of all earlier records, including the Black Sea watershed. In the present paper, we provide a more complete picture of the occurrence, ecology and status of *A. sturio* in the Black Sea, including its tributaries.

RESULTS AND DISCUSSION

Past and present distribution of the Atlantic sturgeon in the Black Sea and its tributaries

The first record of *A. sturio*'s distribution in the Black Sea and its watershed is that of Antipa (1905, 1909). At the beginning of the 20th century, when the sturgeon populations of the Danube-Black Sea area were large, the Atlantic sturgeon was only seldom found. Specimens measuring up to 2 m in length and weighing 80 kg were caught by unbaited hooks. Reports of this species in the Danube River were also scarce. Antipa quotes fisherman, downstream of the Galati River (km 140) at the end of the 19th century, who caught only two specimens of this species during 37 years. It seems that at the time, the Atlantic sturgeon reproduced in the Danube, because Antipa (1933) recorded young-of-the-year sturgeon (5-15 cm) and even hybrids of this species with other sturgeons. He also suggested that *A. sturio* exceptionally spawns at the same time as other sturgeon species, on the sand banks off the Danube estuary. It is true that during the high waters of the Danube, in some years, the entire pre-estuary area is covered with fresh water for 2-3 months, but Borcea (1933) does not admit the Danube estuary to be the functional spawning area. Nevertheless, its spawning grounds have not been localised, and other spawning details also remain unknown.

Very accurate observations on *A. sturio* off the Romanian coast were carried out by Borcea (1929, 1933). He mentioned three specimens with a total length between 47 and 135 cm, caught with a dip net in the area off Agigea, and one specimen measuring 100 cm in the area off Constantza. Later on, Buşnitsa (1966) reported *A. sturio* as far upstream as km 400 on the Danube, but Bănărescu (1964) and Marinov (1978) raised serious doubts about its presence there and included only the Danube delta within its range (Holčík *et al.*, 1989).

Off the Bulgarian coast, the occurrence of *A. sturio* has been even rarer. It has occurred most frequently in the region of Varna and Burgas. Its migration upstream along the Danube to the Bulgarian segment of the river has not been confirmed (Marinov 1966, 1978). This species has occurred more frequently in the Struma and especially in the Maritsa Rivers (Aegean Sea watershed), where its upstream migration was recorded at Plovdiv (Drensky, 1948).

Controversial reports are those of Janković. For the Yugoslavian Danube, she (Janković in Bacalbaşa-Dobrovici *et al.*, 1984; Janković, 1993, 1996) suggested that *A. sturio* would be present from Batina (river km 1422) up to the mouth of the Timok (river km 845) and also from the Djerdap (Iron Gate, river km 945). However, in one paper (Janković, 1994) she does not mention the occurrence of *A. sturio* in the Yugoslavian Danube. Vuković and Ivanović (1973), and, more recently, Simonović and Nikolić (1996), do not mention the occurrence of this species in the Yugoslavian stretch of the Danube, either. As noted by Sal'nikov (1961), the Atlantic sturgeon in the Danube is generally very rare, and practically does not occur here.

The presence of the Atlantic sturgeon along the Anatolian coast, where it was said to be the most numerous on the southern coast of the Black Sea (Pavlov, 1980) and in the Kizil-Irmak and Yesil-Irmak Rivers, as recorded by Zagorovskii (1928, af-

ter Svetovidov 1964), was not confirmed in a recent study (Kinzelbach, 1997).

On the eastern coast of the Black Sea, the Atlantic sturgeon occurred, and is still found, in the area adjacent to the Inguri and Rioni Rivers. Both rivers were entered by spawning shoals of this species up to the village of Dzhvari, some 70 km from the Inguri mouth (Pavliashvili, according to Kasymov, 1972) and regularly to Samtredia and rarely to Akhalsopeli and Bashi, i.e. 120-150 km from the mouth of the Rioni River (Ninua, 1976; Ninua and Tsepkin, 1984). The area inhabited by large juveniles of the Atlantic sturgeon adjacent to the Rioni mouth, up to 50 m in depth, has been estimated at 5 000-7 000 km², and the population density of the adult sturgeon at about 1 000 specimens (Ninua and Tsepkin, 1984).

Adult specimens of the Atlantic sturgeon were also recorded near Crimea, between Simferopol and Yalta, and in Karkinitskii Bay and on the western coast of the Black Sea between Odessa and the Danube River delta (Almazov, 1923, according to Svetovidov, l964; Ninua, 1976).

During the last two decades, there have been no reliable reports of the occurrence of *A. sturio* in the western Black Sea. The probability of its catch is negligible compared with 1960; recently, we found that the number of young sturgeons caught with the dipnet method generally decreased 100-120 times. Most younger fishermen do not know about *A. sturio*. However, the occasional occurrence of *A. sturio* here cannot be rouled out. Also in the eastern Black Sea, in the Rioni River area, the density of the adult *A. sturio* population was reduced to no more than 300 specimens (Ninua and Tsepkin, 1984; Pavlov *et al.*, 1994). Kinzelbach (l997) has also reported that recently the abundance of adults in the area of the Rioni River was reduced to several hundred specimens, and the main reason for that drastic reduction was Georgia's military operations in Abkhazia.

However, the occurrence of *A. sturio* in the western part of the Black Sea is not excluded yet. People from the Fishery and Fish Farming Centre of Galati recently obtained one ripe female sturgeon in the Danube, 300 km from the river mouth. The 40 kg specimen showed some characters of *A. sturio*, but others were specific to *Acipenser gueldenstaedtii* Brandt, 1833. Unfortunately, the female did not survive transport and was sold, so positive identification is now impossible.

In summary, it can be said that the presence of *A. sturio* in the Black Sea at the end of 19th and during the first half of 20th centuries has been reported almost everywhere along the Black Sea coast. The most populated area has been that adjacent to the Rioni and Inguri Rivers on the eastern coast, with its main spawning grounds in the Rioni River. Occasional findings and even reproduction have also been recorded in the Danube River. At present, however, the distribution and also density of *A. sturio* was dramatically reduced. It seems that this species disappeared from the western Black Sea area and the Danube River, and the main –and probably the only– area inhabited by this species at present is the eastern coast of the Black Sea, including the Rioni River, its sole current spawning ground. Considering all aspects of this species's former and present distribution and population density in the Black Sea watershed, it is clear that its extinction is imminent. To save this species will be possible only as a result of the urgent and joint effort of several countries to solve problems involving its artificial reproduction. However, the most difficult task at present is to find enough specimens of parent fish in nature to carry out such work (Pavlov *et al.*, 1994).

The biology of the Atlantic sturgeon in the Black Sea

Because information on the biology of this species in the Black Sea is insufficiently known outside the former Soviet Union, and some aspects differ from those of *A. sturio* from the Atlantic Ocean, Baltic Sea, and the Mediterranean (see also Holčík *et al.*, 1989; Holčík, 2000; Elvira and Almodóvar, 2000), we decided to provide a review of the data presently available.

The first data on the biology of *A. sturio* in the Back Sea watershed were published by Marti (1939), and then used by Berg (1948), Svetovidov (1964), and Elanidze *et al.* (1970). However, the most complete information, based on much more material and observations from 1965-1975, has been published by Ninua (1976). In the following, we used her data.

This species's spawning area in the Rioni River is 120-130 km from its mouth. The lower boundary of the spawning grounds is characterised by a bottom covered with pebbles, and its upper

boundary is limited by high current velocity, being 2 m s^{-1} or more. Spawning begins at the end of April and lasts until the beginning of July, peaking in May. The water temperature at that time varies from 13-18 °C. The upstream sturgeon migration speed extends to 10-15 km day^{-1}. After reaching the spawning grounds the weight of both sexes decreases by 25 %, even as much as almost 50 %, in comparison with initial migration weight. The brood stock of the Atlantic sturgeon in the Rioni River is composed of 6 age groups of males and 10 age groups of females, ranging from 7-12 and 11-20 years in age, respectively. The length of the sexually mature males varies from 96-152 cm and that of females from 110-215 cm, and their weight from 8-20 kg and 15-68 kg, respectively. The fecundity of females 141-215 cm in length and 23-68 kg in weight ranges from 0.789 to 1 815 million eggs. The autumn migration or the winter race of *A. sturio* in the Rioni River has not been observed. The downstream migration of juveniles begins in July, at an age of not less than 2-2.5 months. After reaching the river mouth their length and weight varies between 5-6 cm and 5-5.9 g, respectively. The length and weight of the young-of-the year juveniles in November ranges from 19-23 cm and 30-40 g. At least a part of the juveniles stay in the lower course and the mouth of river during the winter. The majority of the juveniles reach 18-22 cm in length by the end of their first summer. It is estimated that the area (coastal shelf up to 50 m deep) inhabited by large juveniles covers about 5 000-7 000 km^2. The diet of juveniles staying in the river mouth is mostly composed of chironomids, gammarids and pupae of various insects, while the juveniles staying in the sea feed mostly on gammarids, shrimps and fishes. The growth of males and females is almost equal, as females are negligibly longer than the males of the same age. The mean values of the back-calculated total length attained at the end of the 5th, 10th, 15th and 20th year of life is 78.0, 135.5, 183.0 and 214.5 cm, respectively. The life span of males is 12, that of females 20 years.

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